REMARKS

Claims 1, 3-9 and 11-12 are presently pending in the application. Claims 6-9 and 11-12 remain withdrawn from consideration, as directed to non-elected species.

Claim 1 has been amended to recite that a silicon substrate having <110> directional crystal structure is provided (supported at least in paragraph [0031] (as amended) of the specification) and that the anisotropic etching is performed in a vertical direction from a masked surface of the substrate (supported at least in paragraph [0047] of the specification). No new matter has been added by these amendments, and entry is respectfully solicited.

Applicants acknowledge and appreciate the Examiner's indication in the first Office Action that claim 1 is generic to all of the claims. Accordingly, since it is respectfully submitted that claim 1 is allowable for the reasons set forth below, the Examiner is respectfully requested to rejoin all of the pending claims in the application.

In the present Office Action, the Examiner has rejected claims 1-3 and 11-12 under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 5,386,720 of Toda et al. ("Toda"). The Examiner has also rejected claims 4 and 5 under 35 U.S.C. §103(a) as being unpatentable over Toda in view of U.S. Patent No. 4,581,101 of Senoue et al. ("Senoue"). Applicants respectfully traverse these rejections and the arguments in support thereof for the reasons set forth previously on the record, which Applicants rely upon in full, and for the additional reasons which follow, and respectfully request reconsideration and withdrawal of the rejections.

Rejection Under § 102(b) Based on Toda

Regarding claims 1-3 and 11-12, the Examiner argues that Toda teaches a method of fabricating a probe including a cantilever, a body supporting the cantilever, and a tip formed at an end of the cantilever. The Examiner contends, referring in particular to Figs. 3A, B, and H-J, that the method of Toda includes all of the claimed steps. Regarding the dependent claims, Toda allegedly teaches that the silicon substrate has a <110> directional crystal structure and that the mask layers are composed of silicon dioxide (col. 5, line 49 to col. 6, line 24). The Examiner argues, relying on U.S. Patent No. 5,021,364 of Akamine, that the boron diffused layer inherently serves as an etch stop layer in an anisotropic etch process.

In response to Applicants' previous arguments that Toda does not teach a silicon substrate having <110> directional crystal structure, the Examiner argues that as shown in Fig. 3E and 6, the silicon wafer indeed has a <110> directional structure feature, that is, a structure corresponding to the <110> surface. The Examiner argues that Applicants misinterpreted the teaching of Toda of "the <110> direction of the silicon wafer," and concludes that the substrate indeed has "<110> directional crystal structure." Applicants respectfully traverse this rejection as follows.

As previously explained, the present invention is directed to a straightforward, low cost method of fabricating a probe using a silicon substrate with <110> directional crystal structure as a starting material. Using such a method, which involves anisotropically etching the silicon substrate, a probe exhibiting excellent performance can be easily fabricated without a complicated double side alignment process.

The crystal orientation of a silicon wafer which forms a silicon substrate is determined by a silicon ingot growth process as follows. A manufacturer determines the crystal orientation which is to be prepared, such as <100>, <110> or <111>. The ingot is then grown while arranging a mono-crystalline seed in the center on the liquefied surface of silicon, and rotating it at high speed. All silicon crystals in silicon wafers which are grown in this way will be arranged in the same direction as the mono-crystalline seed. That is, a silicon wafer grown using a mono-crystalline seed with <100> direction is called a "<100> directional wafer" and a silicon wafer grown using a mono-crystalline seed with <110> direction is called a "<110> directional wafer."

The crystal orientation of a silicon wafer is very important in the semi-conductor manufacturing process, particularly in an etching process, since the etching speed in a certain direction depends on the specified crystal orientation. For example, a wafer having <110> orientation has a faster etching speed in the right-angular direction than other directions, and a wafer having <100> orientation has a faster etching speed in the 54.7° direction than in any other direction. Consequently, when etching a <100> directional wafer, a V-shaped groove is formed when a mask width is narrow, while a U-shaped groove is formed when a mask width is wide or when an etching is made shorter. However, when etching a <110> directional wafer, an L-shaped groove is formed. Therefore, semiconductor manufacturing processes and characteristics and yields of semiconductor devices depend dramatically on the crystal orientation of the wafer.

As explained in paragraphs [0050] and [0052] of the present application, when a silicon wafer having <100> directional crystal structure or a SOI wafer is used as a starting substrate, a complicated double side alignment process for forming a cantilever is required, thereby complicating the fabrication process. However, utilization of a silicon substrate having <110> directional crystal structure and anisotropic etching causes no silicon to remain on the back surface of the cantilever and the etching to stop at the end of the cantilever. Thus, a double side alignment process for forming a cantilever is not necessary because the silicon substrate is etched in a vertical direction from the surface (see paragraphs [0047], [0051], and [0055]).

In contrast, Toda discloses an integrated AFM sensor containing a cantilever. The sensor is fabricated from a SOI wafer, formed by bonding together silicon layers having a <100> direction (col. 5, lines 52-58). Applicants again maintain that the substrate of Toda does not have the claimed <110> directional crystal structure. Further, Toda's reference to the <110> direction to which the Examiner refers (col. 6, lines 11-13) describes the <u>direction of the patterning shape of the resist</u>, not the <u>directional crystal structure</u> of the silicon substrate. Specifically, Toda teaches "At this time, the resist has the patterning shape extending in the <110> direction of the silicon wafer as shown in Fig. 3E." The "<110>" notation in Figs. 3E and 6 is simply a directional indication (like a compass or reference orientation) and is <u>not</u> the crystal structure of the silicon wafer. In other words, Toda's reference to the <110> direction is merely a way of referring to a particular direction in the diagrams. The Examiner's assertion that Toda's teaching of the "<110> direction of the silicon wafer" is equivalent to a teaching of "<110> directional crystal structure" is incorrect, without basis, and demonstrates the Examiner's complete misunderstanding of Toda and the present invention.

Accordingly, since Toda does not teach or suggest all of the claimed elements, Toda does not anticipate the present claims, and reconsideration and withdrawal of the §102(b) rejection based on Toda are respectfully requested.

<u>*Rejection Under § 103(a) Based on Toda in view of Senoue*</u>

Regarding claims 4 and 5, the Examiner acknowledges that Toda does not teach the step of etching using SF_6, He and O_2 gases. However, Senoue allegedly teaches a dry etch process which utilizes these gases, and that variation of gas ratio causes polymer formation. The Examiner argues that Senoue teaches that the formation of polymer residue at a tip diminishes

the sharpness of the tip. Accordingly, the Examiner concludes that absent any criticality to the claimed etching process and given that SF_6, He and O_2 gases are disclosed in Senoue, it would have been obvious to one having ordinary skill in the art at the time of the invention to utilize these gases in a reactive ion etching process based on the teachings of Senoue. Applicants respectfully traverse this rejection as follows.

As previously explained, Toda does not teach or suggest all of the elements of claim 1, such as preparing a silicon substrate having <110> directional crystal structure. Senoue does not cure this deficiency, since Senoue also does not teach or suggest a silicon substrate having a <110> directional crystal structure. Rather, Senoue teaches a dry-etching process using dry-etching treatment of a semiconductor material by action of a gas, and is silent as to directional crystal structure. Thus, even the proposed combination with Senoue would not teach or suggest all of the claimed elements. Accordingly, claims 4 and 5 are allowable for at least the same reasons as claim 1, and reconsideration and withdrawal of the §103(a) rejection based on Toda in view of Senoue are respectfully requested.

In view of the preceding Amendments and Remarks, it is respectfully submitted that all of the pending claims are patentably distinct from the prior art of record and in condition for allowance. A Notice of Allowance is respectfully requested.

Respectfully submitted,

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Encl: Request for Continued Examination (RCE), Petition for Extension of Time (three months)